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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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EXAMINER

ART UNIT

PAPER NUMBER

DATE MAILED:

05/20/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

# Office Action Summary

Application No.  
**09/677,781**

Applicant(s)  
**Manabe et al**

Examiner  
**S. Mulpuri**

Art Unit  
**2812**



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on amdt filed on 12/1/00
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 19-118 is/are pending in the application.
- 4a) Of the above, claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 53-118 is/are allowed.
- 6) ☒ Claim(s) 19-52 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119

- 13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☒ All b) ☐ Some\* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☒ Certified copies of the priority documents have been received in Application No. 07/926,022.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

## Attachment(s)

- 15) ☐ Notice of References Cited (PTO-892)
- 16) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 3
- 18) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other: \_\_\_\_\_

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## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 19-22,25-28, 29,30, 33-35,3-44 are rejected under 35 U.S.C. 102(b) as being anticipated by Khan et al US 4,614,961.

Kahn et al discloses a method growing epitaxial layers by the following process steps: Providing a sapphire substrate; growing buffer layer of AlN; and then growing a gallium nitride compound layer on AlN buffer layer, wherein gallium nitride compound layer is AlGaN layer. Kahn et al discloses AlGaN layer with n-type dopant concentration approximately at  $10^{18}/\text{cm}^3$ . Kahn et al does not explicitly teach conductivity (1/resistivity). However, since Khan et al teaches the concentration of the n-type dopants is with the limit of the claimed concentration, inherently the conductivity in the Khan et al must be with in the claimed range from 3.4 /ohm-cm to 130 /ohm cm. Khan et al does not examples n-type dopants. However, silicon is the most common and preferred element in the gallium nitride compound semiconductor materials.

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Claims 19-20, 23-24, 27, 30,33,36 rejected under 35 U.S.C. 102(b) as being anticipated by Amano et al (7 th international conference on thin films).

Amano discloses a method of growing gallium nitride compound semiconductor epitaxial layer: Providing a AlN buffer layer, at a temperature of 600 C, on a surface of sapphire; growing ~~Ga~~ epitaxial layer at a temperature of 1040 C on AlN buffer layer, wherein ~~Ga~~ grown with less defects because of the presence of AlN buffer layer (see page 416, lines 1-3, page 417, lines 3-5).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 19, 20, 23-24, 27, 30,33,36, 45-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khan et al in combination with Amano et al.

Khan et al teaches every process steps as claimed. But Khan et al teaches does not (1) mention growing ~~Ga~~ instead of AlGa<sub>N</sub> layer (2) growing AlN buffer layer at lower temperature than epitaxial ~~Ga~~ or AlGa<sub>N</sub> layer. Amano et al teaches growing ~~Ga~~ layer at a temperature 1040 C on the AlN buffer layer grown at 600 C. Amano et al teaches growing buffer layer at lower temperature than gallium nitride compound semiconductor layer is to reduce crystal defects. In the active gallium nitride compound epitaxial layer.

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Claims 53-118 is allowed.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Prior art, in general, teaches epitaxial growth of gallium nitride compound semiconductor layers. Koide et al(solid state science and technology) teaches growing undoped Gas by providing trimethyl gallium at a temperature of -15 C to -12.5 C. Keyyan Rahim Sayyah (PTO 1149) teaches the flux ratio of silane and TMG is in the range of  $10^{-2}$  to  $10^{-1}$

Any inquiry concerning this communication or earlier communications from the examiner should be directed to S. Mulpuri whose telephone number is (703) 305-5184. The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

  
SAVITRI MULPURI  
PRIMARY EXAMINER